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The use of a positive mood induction video-clip to target eating
behaviour in people with bulimia nervosa or binge eating disorder: An
experimental study

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Abstract

Recent theoretical models and empirical research have indicated that momentary negative affect increases the likelihood of binge eating episodes for individuals with bulimia nervosa and binge eating disorder. However, relatively little research has explored the potential for positive mood to serve a protective effect in reducing the likelihood of overeating behaviour in bulimia nervosa and binge eating disorder. The current study included 30 women with bulimia nervosa or binge eating disorder in a within-subjects crossover design. Following exposure to a video designed to induce food craving, we found that a positive mood vodcast was associated with significantly lower levels of negative mood and food consumption in a taste test meal, when compared to a neutral vodcast ($p = .002$). These findings support a role for decreasing negative mood in reducing the likelihood of binge eating behaviour in women with bulimia nervosa and binge eating disorder.

KEYWORDS: Bulimia nervosa; Binge eating disorder; Mood induction; Positive affect; Vodcast

Introduction

Bulimia nervosa and binge eating disorder are eating disorders characterised by repeated episodes of loss of control over eating (American Psychiatric Association, 2013). Recent theoretical models suggest that difficulties in emotion regulation (Haedt-Matt & Keel, 2011; Hawkins & Clement, 1984; Leehr et al., 2015) and the tendency to act impulsively in response to negative emotions (i.e., negative urgency) (Wolz, Granero, & Fernández-Aranda, 2017) interact to trigger loss-of-control eating episodes (K. D. Becker, Fischer, Smith, & Miller, 2016; Haedt-Matt & Keel, 2011; Hawkins & Clement, 1984).

The contribution of emotion regulation difficulties to disordered eating behaviours has been partially supported by studies utilising momentary ecological assessments (i.e. repeated electronic assessments throughout the day). These studies show that negative mood and decreased positive affect often precede binge eating episodes and compensatory behaviours in patients with bulimia nervosa or binge eating disorder (K. R. Becker, Fischer, Crosby, Engel, & Wonderlich, 2018; Goldschmidt et al., 2014; Haedt-Matt & Keel, 2011; Lavender et al., 2016) and that greater negative affect instability characterises days when loss-of-control eating occurs (Berner et al., 2017; Stevenson, Dvorak, Wonderlich, Crosby, & Gordon, 2018).

Results across studies which have measured the effect of experimentally-induced negative mood on eating behaviours are somewhat mixed in clinical populations (Evers, Dingemans, Junghans, & Boevé, 2018). One meta-analytic review has found that experimentally-induced negative mood led to greater food intake among people with binge eating disorder and those at risk of developing binge-type eating disorders (Cardi, Leppanen, & Treasure, 2015). A more recent meta-analysis found that the effect of negative mood on increased food consumption was only marginally significant and significantly moderated by the method of mood induction (Evers et al., 2018).

The role of positive affect in modulating eating behaviour has been less investigated. A recent meta-analysis found that positive mood induction tended to increase food consumption when pooling together data from healthy, sub-clinical, and clinical populations (Evers et al., 2018). However, studies exclusively conducted in people with bulimia nervosa or binge eating disorder suggest that positive mood is rather associated with a reduced likelihood to binge eat or overeat (K. R. Becker et al., 2018; Munsch, Meyer, Quartier, & Wilhelm, 2012; Udo et al., 2013; Yeomans & Coughlan, 2009). One possible explanation for these findings is that the presence of a binge-type eating disorder moderates the effect of positive mood on eating behaviour due to stronger expectations of negative emotional reactivity following overeating (Levinson et al., 2017; Wegener & Petty, 1994) or due to greater accessibility of ongoing goals to curb binge eating behaviour (Shah, 2003).

These explanations are in line with the predictions of a number of theories in the field of positive psychology. For example, Wegener and Petty's (1994) hedonic contingency hypothesis proposes that individuals experiencing positive affect are more likely to choose future behaviours on the basis of the expected emotional consequences of that behaviour, which, in the context of bulimia nervosa and binge eating disorder, would entail expectations of negative emotions such as guilt and shame following loss of control over eating. Furthermore, the "broaden-and-build" theory (Fredrickson, 2001) posits that positive emotions increase the availability of momentary thought-action repertoires and undo lingering negative emotions, thus reducing the likelihood that pre-existing unhelpful habits are triggered (e.g. associations between negative mood and loss of control over eating).

The aim of the present study was to examine the impact of a short video-clip designed to induce positive mood on the consumption of a standardised test meal in a clinical sample of participants with bulimia nervosa or binge eating disorder. It was hypothesised that the reduction of negative mood would reduce the number of calories consumed during the test

meal, when compared to calories consumed following a neutral video-clip (neutral vodcast). It was also hypothesised that listening to the positive mood vodcast would be associated with lower desire to eat and lower expectations that eating would provide relief after the test meal, as compared to the neutral vodcast condition. The success of the experimental manipulation (positive mood induction) was checked by measuring negative mood after watching the positive mood or neutral video-clips.

Methods

Participants

Thirty women with either bulimia nervosa or binge eating disorder took part in the study. Participants were recruited through eating disorder charity websites (BEAT, Succeed) and amongst King's College London students and staff. Diagnoses were confirmed with the Structured Clinical interview for DSM-5 – research version (SCID) (First, 2015). The SCID was administered by Master's-level and PhD-level psychology students who had received specific training in correct use of the SCID.

Exclusion criteria for the participants were body mass index (BMI) lower than 18.5, diagnosis of an eating disorder other than bulimia nervosa or binge eating disorder, self-reported substance misuse, visual impairment not corrected by lenses, and difficulties understanding written and spoken English. All participants provided written, informed consent prior to taking part in the study and all procedures were conducted in accordance with the latest Declaration of Helsinki. All participants were compensated for their time. The study was approved by the Psychiatry, Nursing & Midwifery Research Ethics Committee at King's College London (PNM/11/12-3).

116 *Self-report questionnaires*

117 At baseline, participants completed a demographic and clinical questionnaire requesting
118 information on gender, ethnicity, age, years of education, eating disorder diagnosis, illness
119 duration (in years), diagnosis of psychiatric disorders in the family, and psychiatric medication.
120 This questionnaire also included the Eating Disorder Examination Questionnaire (EDEQ)
121 (Fairburn & Beglin, 1994), a 36-item self-report instrument assessing eating disorder
122 psychopathology over the past 28 days. Items in the EDEQ are provided in the form of a 7-
123 point Likert scale, such that higher overall scores indicate greater eating disorder
124 psychopathology. Before and after the mood induction video-clip and taste test, participants
125 completed visual analogue scales to assess state-related changes in negative mood (ranging
126 from 0 - “not at all” - to 10 - “extremely”) and the Food Craving Questionnaire (state version)
127 (FCQ-S; (Cepeda-Benito, Gleaves, Williams, & Erath, 2000)), a 15-item self-report measure
128 to assess state-dependent food craving.

129

130 *Food craving induction*

131 Food craving was induced with a two-minute video clip along with exposure to the snack
132 foods used during the taste test. The video depicted various people eating highly palatable
133 foods and has been used to successfully induce food craving in a study involving participants
134 with bulimic-type eating disorders (Fregni et al., 2008).

135

136 *Vodcast conditions*

137 The positive mood vodcast was designed to be uplifting and consisted of positive
138 classical music (Mozart’s Toy symphony) along with spoken word statements from the Velten
139 (1968) laboratory positive mood induction task. The neutral vodcast consisted of classical

music by Holst (Planets: Neptune the Mystic) along with neutral statements from the laboratory mood induction task by Velten (1968). Both vodcasts lasted 15 minutes and have been previously used among healthy individuals and people with anorexia nervosa (Cardi, Esposito, Clarke, Schifano, & Treasure, 2015).

Taste test

The taste test is a commonly-used, validated measure of palatable eating behaviour (Robinson et al., 2017). Whilst watching the positive mood or neutral vodcasts, participants were instructed to taste the snack foods of the taste test. They were told that they could eat as much or as little of the snack foods as they wanted and were required to rate each item according to appearance, smell and taste. These ratings were not included in the analyses because they were only collected to ensure credibility of the study demand (i.e. participants were told that the study aim was to test differences in taste amongst individuals). The snack foods consisted of six chocolate chip cookies, eight “Celebrations” chocolates, 25g of potato crisps, and 30g of salted peanuts. All food items were presented in individual porcelain bowls.

Design and procedure

The study used a randomised, within subjects, crossover design. The order of the vodcast conditions was randomised across participants. Thirteen out of twenty participants with BN received the positive mood vodcast first (59.1%), whilst five out of eight participants with BED received the positive mood vodcast first (62.5%). This difference in proportions was not significant ($p = .511$).

Participants were tested in the afternoon, between 4 pm and 6 pm, in a laboratory. They were instructed not to eat any foods for the two hours prior to their participation in the study.

Levels of hunger were measured before starting the experiment using a visual analogue scale ranging from 0 (not at all) to 10 (very much). During the first session, participants completed the demographic and clinical questionnaires. At the beginning of each study session, they were exposed to the snack foods of the taste test and asked to watch the food craving video clip. Following the video-clip, participants completed the FCQ-S and the negative mood visual analogue scale. Participants were then left alone in the room and asked to watch a 15-minute vodcast (either neutral or positive mood induction, depending on the session). Whilst watching the vodcast, they were told they could eat as much or as little of the snack foods as they wanted and were requested to rate each item according to appearance, smell and taste. Finally, participants completed the FCQ-S and the negative mood visual analogue scale once more.

Statistical analysis

All statistical analyses were conducted in R using the lme4 package (Bates, Mächler, Bolker, & Walker, 2015; R Core Team, 2017). The mood manipulation check was conducted with a linear mixed effects model with time (before vodcast, after vodcast) and condition (neutral vodcast, positive mood vodcast) as fixed effects and a random intercept. The effect of the positive mood vodcast on caloric consumption during the taste test was explored with a linear mixed effects model with condition (neutral vodcast, positive mood vodcast) as the fixed effects predictor and a random intercept. Similarly, the impact of the vodcast on FCQ-S (desire to eat and anticipation of relief subscales selected *a priori*) was examined with linear mixed effects models. Time (before vodcast, after vodcast) and condition (neutral vodcast, positive mood vodcast) were entered as fixed effects along with a random intercept. All mixed effects models were conducted with the *lmer* command, the *anova* command was used to produce ANOVA-like output, and degrees of freedom were estimated with Satterthwaite approximation. Post-hoc pairwise tests were conducted with the *lsmeans* package (Lenth, 2016). The *lsmeans*

189 package reports the effective degrees of freedom for the pooled sample variances, which is
190 approximated using the Welch-Satterwaite equation.

191

192

Results

Sample characteristics

The majority of the sample, 73% ($n = 22$), had a diagnosis of bulimia nervosa and the remaining 27% of the sample ($n = 8$) had a diagnosis of binge eating disorder. Six participants reported taking psychotropic medication at the time of their participation in the study and seven participants reported a comorbid diagnosis of depression. Mean baseline hunger in the neutral vodcast condition, as recorded in the VAS, was equal to 5.77, $SD = 3.74$. Mean baseline hunger in the positive vodcast condition was equal to 5.84, $SD = 3.14$. There was not a significant difference in the baseline hunger of participants in the neutral vodcast condition, versus the positive vodcast condition ($t(28) = -0.09$, $p = .926$). The sample characteristics are summarised in **Table 1**. The two clinical samples were not statistically compared due to the small sample size of the group of participants with binge eating disorder.

Variable	Bulimia Nervosa ($n = 22$) Mean (SD)	Binge Eating Disorder ($n = 8$) Mean (SD)	Total sample ($N = 30$) Mean (SD)
Age (Years)	24.29 (5.87)	29.88 (11.75)	25.83 (8.10)
Body Mass Index	23.12 (6.93)	27.14 (4.77)	24.27 (6.56)
Duration of illness (Years)	5.31 (6.17)	3.29 (5.56)	4.70 (5.94)
Eating Disorder Examination Questionnaire (total score)	3.98 (1.23)	3.97 (1.22)	3.98 (1.20)

Note. SD = standard deviation.

Table 1. Sample characteristics

Manipulation check: negative mood visual analogue scale

The linear mixed effects model revealed a significant main effect of condition, with participants reporting significantly more negative mood in the neutral vodcast condition than the positive mood vodcast condition across time points. There was also a significant condition

by time interaction, which was explored further with post-hoc tests. Post-hoc tests showed that participants reported less negative mood after the vodcast in the positive mood condition ($t(83) = -2.74, p = 0.008$). There was no significant change from before to after vodcast in the neutral condition ($t(83) = 0.89, p = 0.376$). Additionally, there was a significant difference in negative mood ratings between the two conditions after the vodcast, with those in the positive mood condition reporting less negative mood ($t(84) = -4.72, p < 0.0001$). There was no significant difference in negative mood ratings between the two conditions before exposure to the vodcast ($t(84) = -1.08, p = 0.284$). The negative mood ratings for each condition, before and after watching the vodcast, are reported in **Table 2**. Wald tests associated with fixed effects entered in the linear mixed model are reported in **Supplementary Table 1**. The variance of the random intercept was equal to 4.851 and the variance of the residuals was equal to 4.188.

Vodcast condition	Time	Negative mood rating (0-10) Mean (SD)	$F(df)$ statistic, p -value
Neutral	Before vodcast	6.14 (2.89)	Time: $F(1, 83) = 1.83, p = 0.179$
	After vodcast	6.61 (2.79)	Condition: $F(1, 85) = 16.62, p = 0.0001$ Condition x time: $F(1, 83) = 6.71, p = 0.011$
Positive mood	Before vodcast	5.60 (3.36)	
	After vodcast	4.10 (3.05)	

Note. SD = standard deviation; DF = degrees of freedom

Table 2. Negative mood ratings in the positive mood and neutral vodcast conditions

Test meal intake

Caloric intake during the taste test in the positive mood and neutral vodcast conditions is presented in **Figure 1**. There was a significant difference between the two conditions, with participants consuming fewer calories in the positive, versus neutral, vodcast condition ($F(1, 29) = 10.98, p = 0.002$). The Wald test for the mixed linear model revealed a significant fixed

effect of vodcast condition equal to -91.77 , $SE = 27.70$, $df = 29.00$, $t = -3.31$, $p = .002$. The variance for the random intercept was equal to 20579, and the variance of the residuals was equal to 11510. The effect of vodcast condition remained significant after controlling for baseline mood. The results of this follow-up analysis are reported in **Supplementary Table 2**.

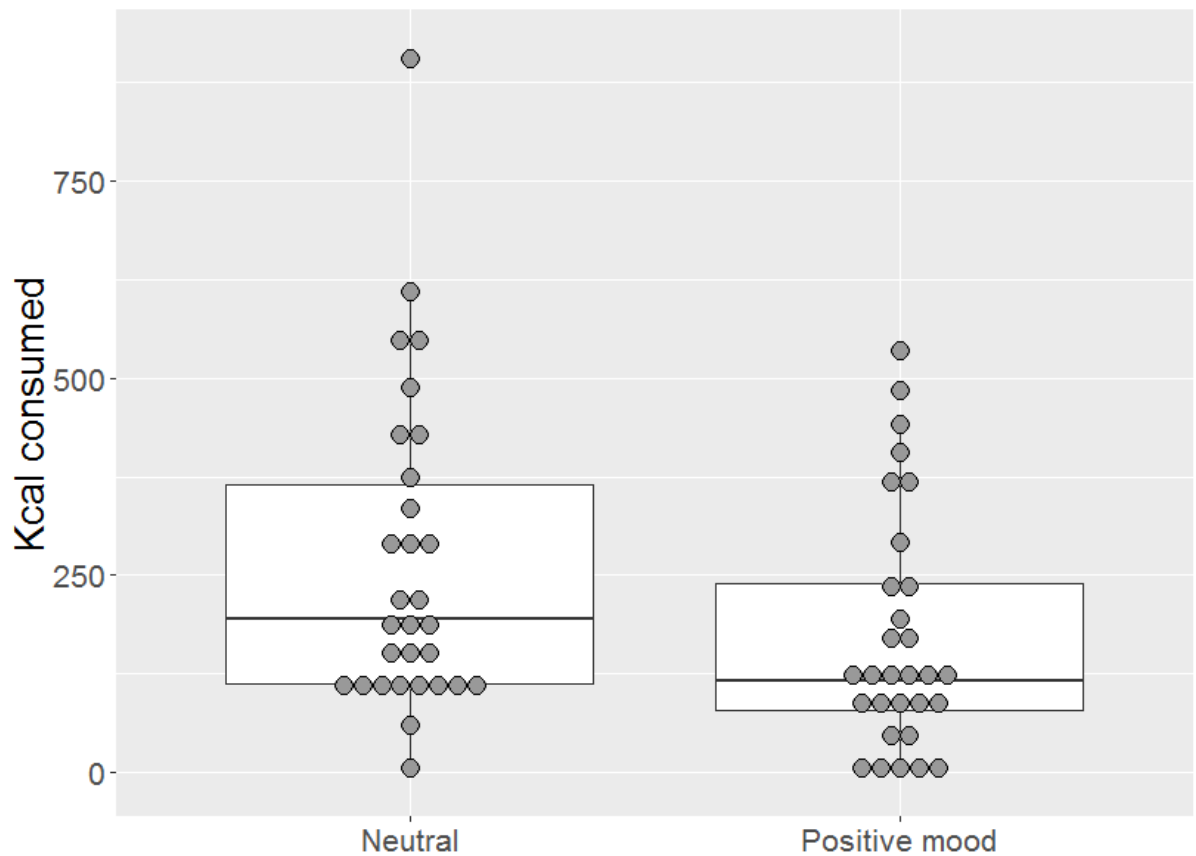


Figure 1. Caloric intake during the taste test in the positive mood and neutral vodcast conditions, expressed in kilocalories (kcal)

Desire to eat and Anticipation of relief

The scores for “desire to eat” and “anticipation of relief” on the FCQ-S in both the neutral and positive mood vodcast conditions are presented in **Table 3**. The linear mixed effects model for “desire to eat” showed a significant main effect of condition. The participants

reported significantly more desire to eat in the neutral condition than the positive mood condition across time points ($t(86) = 3.43, p = 0.0009$). The variance of the random intercept was equal to 3.757 and the variance of the residuals was equal to 7.030. The Wald tests associated with the fixed effects of the linear mixed model are reported in **Supplementary Table 3**. The linear mixed effects model for “anticipation of relief” showed a significant main effect of condition and time. Participants reported higher scores in the neutral vodcast condition than in the positive mood vodcast condition across time points ($t(85) = 2.64, p = 0.010$). They also reported significantly more anticipation of relief before exposure to the vodcasts than after, across vodcast conditions ($t(84) = 2.07, p = 0.041$). The variance of the random intercept is equal to 5.159 and the variance associated with the residuals is equal to 3.796. The Wald tests associated with the fixed effects entered in the linear mixed model for anticipation of relief are reported in **Supplementary Table 4**.

Scale	Condition	Time	Rating (0-10) Mean (SD)	F (df) statistic, p-value
Desire to eat	Neutral	Before vodcast	10.73 (2.85)	Time: $F(1, 86) = 1.78, p = 0.185$ Condition: $F(1, 85) = 11.74, p = 0.0009$ Condition x time: $F(1, 85) = 0.86, p = 0.357$
		After vodcast	10.53 (3.72)	
	Positive mood	Before vodcast	9.55 (3.32)	
		After vodcast	8.45 (3.18)	
Anticipation of relief	Neutral	Before vodcast	7.60 (3.19)	Time: $F(1, 85) = 6.98, p = 0.010$ Condition: $F(1, 84) = 4.29, p = 0.041$ Condition x time: $F(1, 84) = 2.30, p = 0.133$
		After vodcast	7.40 (3.39)	
	Positive mood	Before vodcast	7.14 (2.91)	
		After vodcast	5.79 (2.36)	

Note. SD = standard deviation; df = degrees of freedom

Table 3. Scores for “desire to eat” and “anticipation of relief” in the positive mood and neutral vodcast conditions

Discussion

The aim of the present study was to explore the impact of a positive mood vodcast on food consumption during a taste test in women with bulimia nervosa or binge eating disorder. Levels of desire to eat and anticipation of relief were also assessed before and after the taste test and watching the vodcast. The manipulation check was successful, showing that participants reported significantly less negative mood after exposure to the positive mood vodcast. The findings also showed that the positive mood vodcast led to a significant reduction in calories consumed during the taste test. The vodcast intervention did not lead to a significant change in self-reported desire to eat and anticipation of relief.

The present findings align with previous experimental work documenting reduction in food consumption during a test meal following positive mood induction among obese individuals and healthy people reporting bulimia nervosa-like symptoms (Udo et al., 2013; Yeomans & Coughlan, 2009). The current findings therefore add to a body of existing literature which suggests that this inhibitory effect of positive mood induction on hedonic food intake may be specific to individuals with binge-eating tendencies, as opposed to the general population (Evers et al., 2018).

A possible explanation for the effect of the positive mood vodcast on reduced calorie consumption is that positive emotions increase the availability of momentary thought-action repertoires whilst reducing the likelihood that pre-existing unhelpful habits are triggered (Fredrickson, 2001). In a similar manner, this mechanism would explain the impact of the same mood induction procedure in a sample of people with anorexia nervosa, who increased consumption of a standard laboratory fruit smoothie after positive mood induction compared to a control condition (Cardi, Esposito, et al., 2015).

The hypothesis that experimentally-induced positive mood reduces the access to automatic and unhelpful eating behaviours and cognitions by increasing access to a repertoire of

alternative helpful eating behaviours and cognitions remains to be tested. The exposure to a variety of personally-relevant high palatable foods and the measurement of self-reported cravings and physiological reactivity during exposure would enable testing this hypothesis more directly.

Limitations

The main limitation of the present study was the relatively small sample size, particularly the small number of individuals with binge eating disorder. This prevented statistical comparison of bulimia nervosa and binge eating disorder groups due to lack of power to detect true differences. However, the overall goal of the study was to test the impact of positive mood induction on the tendency to overeat, a symptom commonly shared by these two different clinical presentations. We did not examine whether the food craving induction was successful with self-report measures, nor did the current study measure positive mood directly, rather measuring reductions in negative mood. Additionally, this study recruited women exclusively, therefore limiting the generalisability of the current findings to men with bulimia nervosa and binge eating disorder. The average duration of illness was 5.31 years for women with bulimia nervosa and 3.29 years for women with binge eating disorder in the current study. Therefore, it is still unclear to what extent positive mood induction may affect eating behaviour in women with longer durations of illness. Future studies may benefit from exploring the impact of cue induced food craving using visual analogue scales or physiological measures, and exploring the impact of positive mood induction in everyday life settings through the use of ecological momentary assessment.

Clinical implications

Current treatments for binge-type eating disorders are only effective for a subgroup of patients (Eddy et al., 2017; Hay, 2013; Shingleton, Thompson-Brenner, Thompson, Pratt, &

Franko, 2015) and therefore the development of novel treatment approaches is warranted in the field (Treasure, Cardi, Leppanen, & Turton, 2015; Treasure, Leslie, Chami, & Fernández - Aranda, 2018). The current study indicates that positive mood induction techniques, which successfully reduce negative mood, present a promising avenue to reduce the likelihood of hedonic eating in women with bulimia nervosa and binge eating disorder. Considering the great potential of mobile interventions (which are highly scalable and flexible), it would be interesting to test whether the use of a mobile application offering a variety of personalised strategies to induce positive mood would be beneficial in reducing unhelpful eating behaviours in people with loss of control over eating.

Conclusions

The current study investigated the effect of listening to a podcast designed to induce positive mood on subsequent eating behaviour in women with bulimia nervosa and binge eating disorder. The positive mood podcast was associated with significantly reduced levels of negative mood and reduced caloric consumption in a taste test meal, when compared to a neutral mood podcast. The current findings support the protective role of positive mood induction exercises in deterring binge eating behaviour. We recommend that future research studies explore the effect of repeated positive mood induction on clinical outcomes in larger, longitudinal studies of bulimia nervosa and binge eating disorder to gauge the utility of incorporating positive mood induction within treatment for binge-type eating disorders.

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